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Biological Features of Saline Wetlands in Lancaster County, Nebraska

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BIOLOGICAL FEATURES OF SALINE WETLANDS IN LANCASTER COUNTY, NEBRASKA

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The natural history of saline wetland areas near Lincoln, Lancaster County, was evaluated. Most remaining salt marshes occur on saline soils along Little Salt Creek. Numerous plant species of saline soils occur that are limited to this part of the State. The avifauna is diverse, with 67 species recorded during the breeding season, 47 of them breeding. Because wetlands are limited in distribution in Nebraska, key biological elements, potential threats to the areas, and management considerations are discussed.

† † †

INTRODUCTION

Salt marshes occur in eastern Nebraska only near Lincoln, on lowlands in the Salt Creek Basin. They are very limited compared to other plant community types in Nebraska, and have been considered an endangered habitat (Kaul, 1975). A few small salt marshes are found here and there in the Sandhills and North Platte River Valley.

The Lancaster County salt marshes were once extensive on lowlands along the creeks, but changes in land use through the decades have drastically reduced them. The remaining sites are so limited that additional disturbances could destroy entirely a representative plant community.

There is need for an active conservation effort to identify, evaluate, and protect the remaining salt marshes. Conservation of these sites would protect:

1. unique salt-marsh plant communities that are the result of prehistoric conditions on the Great Plains.
2. salt-marsh vegetation important in ecological research.
3. wetland habitat used by an impressive variety of native wildlife, especially birds.
4. natural lands and the value they have for environmental education and outdoor recreation.
5. native prairie land.

The saline wetlands result from groundwater seeping to the surface from the Dakota Formation (Shirk, 1924). The salt was initially formed millions of years earlier when a vast inland sea covered central North America. White alkaline deposits can often be found on the ground in some of these wetlands.

I have compiled information on these areas to identify their biological features that should be conserved.

METHODS

I determined the location of some wetlands from references listing areas visited by bird watchers, and I found other sites by using U.S. Geological Survey topographic maps. I also used aerial photographs to assess the extent of marshland along Little Salt Creek. I made nearly 60 visits since 1980 to evaluate the avifauna in the North 27th Street area, and I visited the other sites periodically from 1984 through 1986.

Other biologists provided information from their field work, including persons from the University of Nebraska–Lincoln, the University of Chicago, the Nebraska Game and Parks Commission, and bird watchers from the Wachiska Audubon Society. Popular articles also have information on the history of saline marshes near Lincoln (Cunningham, 1985; Ducey, 1985, 1987).

SOILS

The saline soils belong to the Salmo Series of deep, poorly drained bottomland soils of low permeability (Soil Conservation Service, 1980). They formed on silty alluvium that is slightly to moderately affected with soluble salts. This soil type commonly occurs near creeks, intermittent lakes, and marshes, and is usually only briefly flooded (Table I). Salt-marsh soils in general are highly saline and have a high water-holding capacity (Ungar, 1969).

TABLE I. Characteristics of Salmo Series soils in Lancaster County.

Soil Type	Range Type	Acres	Percent	Flooding		Salinity
				Duration	Months	Mmhos/cm
Sa	saline lowland	900	0.2	brief	Mar–Oct	4–16
Sb	saline subirrigated	2,300	0.4	brief	Mar–Oct	4–16
Sc	saline subirrigated	2,480	0.5	brief	Mar–Oct	4–16

TABLE II. Representative flora noted at saline wetlands near Lincoln, Lancaster County. Additional species would be expected with a more comprehensive survey.

PLANT SPECIES Common name and Scientific Name	LOCALITY						
	AIRPORT FLATS	CAPITOL BEACH	R.R. YARDS	LAGOON PARK	NORTH 40th	NORTH 27th	NORTH L. SALT
Alkali bluegrass. *Poa juncifolia* Scribn.	—	—	—	—	X	—	—
Alleghany monkey-flower. *Mimulus ringens* L.	—	—	—	X	—	—	—
Annual iva. *Iva ciliata* Willd.	—	X	X	—	X	X	—
Bearded sprangletop. *Leptochloa fascicularis* (Lam.) Gray	—	—	—	X	—	X	—
Bluestem. *Andropogon* spp.	—	—	—	—	—	X	X
Blue grama. *Bouteloua gracilis* (H.B.K.) Griffiths	—	—	—	X	—	—	X
Buffalo grass. *Buchloe dactyloides* (Nutt.) Engelm.	—	—	—	X	—	—	—
Cattail. *Typha* spp.	—	X	—	X	X	X	X
Common reed. *Phragmites australis* (Cov.) Trin.	—	—	X	—	—	—	—
Cottonwood. *Populus* sp.	—	—	—	—	X	X	—
Ditchgrass. *Ruppia maritima* L.	—	—	—	—	—	X	—
Elm. *Ulmus* sp.	—	—	—	—	—	X	—
Fern flatsedge. *Cyperus filiculmis* Vahl	—	—	—	—	—	—	X
Gayfeather. *Liatris* sp.	—	—	—	—	—	—	X
Goldenrod. *Solidago* spp.	—	—	—	—	—	X	—
Hackberry. *Celtis occidentalis* L.	—	—	—	—	—	X	—
Large alfalfa dodder. *Cuscuta indecora* Chois.	—	—	—	X	—	—	—
Ludwigia. *Ludwigia peploides* (H.B.K.) Raven	—	—	—	X	—	—	—
Plains bluegrass. *Poa arida* Vasey	—	—	—	—	—	X	—
Prairie cordgrass. *Spartina pectinata* Link	—	—	—	—	X	—	X
Prairie cupgrass. *Eriochloa contracta* Hitchc	—	—	—	X	—	—	—
Prickly pear. *Opuntia* sp.	—	—	—	X	—	—	—

Table II (Continued on page 7)

Table II (Continued from page 6)

Redroot Cyperus. *Cyperus erythrorhizos* Muhl	—	—	—	X	—	—	—
Redscale. *Atriplex rosea* L.	X	X	—	X	—	—	—
Sago pondweed. *Potamogeton pectinatus* L.	—	—	—	—	—	X	—
Salt grass. *Distichlis spicata* L.	X	X	—	X	X	X	X
Saltmarsh aster. *Aster subulatus* var. *ligulatus* Shinners	—	—	—	—	—	X	—
Saltwort. *Salicornia rubra* L.	X	X	—	—	X	X	X
Sea blite. *Suaeda depressa* (Purch) Wats.	X	X	—	X	X	—	
Sedge. *Carex* spp.	—	X	—	X	X	X	X
Sideoats grama. *Bouteloua curtipendula* (Michx.) Torr.	—	—	—	—	—	—	X
Seaside heliotrope. *Heliotropium curassavicum* L.	—	—	—	X	—	—	—
Seaside saltgrass. *Distichlis spicata* (L.) Greene	X	X	X	X	X	X	X
Slender flatsedge. *Cyperus ferruginescens* Boeckl.	—	—	—	X	—	—	—
Spearscale. *Atriplex* spp.	X	X	—	—	—	X	—
Spikesedge. *Eleocharis* spp.	X	—	—	—	X	X	X
Swamp milkweed. *Asclepias incarnata* L.	—	—	—	X	—	—	—
Switchgrass. *Panicum virgatum* L.	—	—	—	—	—	—	X
Texas dropseed. *Sporobolus texanus* Vasey	—	—	—	—	—	X	—
Tooth-cup. *Ammannia coccinea* R.H.B.	—	—	—	X	—	—	—
Western snowberry. *Symphoricarpos albus* L. Blake	—	—	X	—	—	X	—
Western wheatgrass. *Agropyron smithii* Rydb.	—	—	—	X	—	—	—
Willow. *Salix* spp.	X	X	—	—	X	—	—
Yerba–de–tajo. *Eclipta alba* (L.) Hassk.	—	—	—	X	—	—	—

TABLE III. Summary of habitat types of saline wetlands near Lincoln, Lancaster County.

	LOCALITY						
HABITAT TYPE	AIRPORT FLATS	CAPITOL BEACH	R.R. YARDS	LAGOON PARK	NORTH 40th	NORTH 27th	NORTH L. SALT
Alkaline Meadow	X	—	X	X	—	X	X
Cattail Marsh	—	X	—	X	X	X	X
Cordgrass Meadow	—	—	—	—	X	—	X
Lowland Woods	X	X	—	—	—	X	X
Mud Flats	X	—	—	—	X	X	X
Native Prairie	—	—	—	X	—	X	X
Open Water-Lake	—	X	—	X	X	X	X
Riparian Woods	—	—	—	—	—	X	—
Sedge Marsh	—	—	—	—	—	X	—
Shrubland	—	—	—	—	—	X	—
Weedy Lowland	—	—	—	—	—	X	—

Three soils are classified in the Salmo Series:

1. Salmo silt loam, *Sa*, is a nearly level, poorly drained soil of bottomlands, and is occasionally flooded. Shallow depressions and meandering drains are common.

2. Salmo silty-clay loam, *Sb*, is channeled with 0–2% slope. It is a nearly level, poorly drained soil found frequently on bottomlands. Shallow depressions and meandering drains are common. Prairie cordgrass is the commonest plant, but overgrazed areas are invaded by inland saltgrass.

3. Salmo silty-clay loam, *Sc*, ha 0–2% slope. It is located on poorly drained bottomland that is occasionally flooded.

SALT-MARSH VEGETATION

Although there have been no complete botanical surveys, herbarium specimens, literature notes, and field observations document most plant speices of the saline soils. Several species are abundant, but others occur in just few of the wetlands. The growing conditions are so variable that the flora varies from site to site. Table II lists representative species in the sites.

A variety of terrestrial and aquatic plant communities have been identified at some of these saline wetlands (Ungar, 1969), and their distribution, as well as that of other habitats typical of southeastern Nebraska, is summarized in Table III for most of the salt-marsh areas visited. (Scientific names of plants are given in Table II.)

Subtle differences in topography, soils, and drainage influence the vegetation and create, in some places, many different plant associations in small areas. The most important factor affecting plant occurrence and distribution in the salt marshes is the osmotic concentration of the soil solution (Ungar, 1969). A reduction in soil salinity results in an increase in cover or species numbers, but not necessarily both. Sea blite is the most salt–tolerant species, and is usually the first to invade barren salt flats; where salinity is reduced along the border of saline areas, numerous prairie species invade (Ungar, 1969).

Because the distribution of salt-marsh plants (halophytes) fluctuates with precipitation and temperature within and among the sites (Shirk, 1924), an extensive area of saline soils is needed to ensure that suitable habitat remains somewhere.

DIATOMS

Diatoms specific to saline environments are known from these salt marshes. Elmore (1921) collected five species near Little Salt Creek at the now-vanished settlement of Arbor: *Synedra fasciculata, Navicula crucicula, Entomoneis alata, Nitzschia hungarica,* and *N. acicularis*.

AVIFAUNA

Bird enthusiasts have been keeping records of salt-marsh bird life for nearly 100 years (Hunter, 1900, and about 30 other references in publications of the Nebraska Ornithologists' Union). The open water, marshes, meadows, prairie, and woods provide habitat for a large and diverse avifauna. More than 230 breeding and migrating species have been recorded in the last 90 years (Ducey, 1985). Nomenclature used here is from American Ornithologists' Union (1983), and scientific names are given in Table IV.

Perhaps the most interesting part of the avifauna is the diversity of non-breeding shore and water birds. Historic observations of migratory species include white–faced ibis, snowy egret, lesser golden plover, Hudsonian godwit, black–bellied plover, snowy plover, mountain plover, red knot, and long–billed curlew. Recent records include sightings of the black rail, king rail, black–necked stilt, and black–legged kittiwake (Ducey, unpublished manuscript).

Notable breeding birds recorded in the early 1900's included snowy egret (Eiche, 1901), piping plover (Pickwell, 1925), and scissor–tailed flycatcher (Dawson, unpublished notes). Potential breeders were least tern and sedge wren.

Among the 67 species noted in recent years are some of very limited breeding occurrence in the State (Table IV): least bittern, common moorhen, king rail, and great–tailed grackle. Waterfowl, shore birds, and icterids are the largest groups.

The habitat diversity of the saline wetlands is apparent in the breeding avifauna. Each area has certain vegetative communities needed by particular species. At the North Little Salt site, the wetland meadows are used by bobolinks. Federation Marsh, with its bordering woodlands, has five species not noted elsewhere: green-backed heron, green-winged teal, northern rough-winged swallow, marsh wren, and northern cardinal. A limited amount of prairie at the North Little Salt and North 40th Street sites is used by the grasshopper sparrow.

Breeding species at Capitol Beach that have not been found breeding in the other sites are northern shoveler, ruddy duck, king rail, Virginia rail, rock dove, tree swallow, and blue grosbeak (Table IV). The rock dove indicates the proximity of the area to the urban nesting sites that these birds use.

TABLE IV. Species and location of breeding season occurrence of birds associated with Salt Creek wetlands. Species that have had nesting confirmed are marked with an asterisk (*). These are combined observations of J. Ducey (1980–83, 1985, 1986) for areas along Little Salt Creek, W. Garthright (1983–85) primarily for Capitol Beach and Federation Marsh, D. Showen at Lagoon Park (1984–86), and P. Johnsgard for Lagoon Park and North 27th (1985–87).

BIRD SPECIES	LOCATION				
	CAPITOL BEACH	LAGOON PARK	NORTH 40th	NORTH 27th	NORTH L. SALT
American coot. *Fulica americana* Gmelin	X*	X	—	X*	—
American goldfinch. *Carduelis tristus* (Linnaeus).	X*	X	X	X	—
American robin. *Turdus migratorius* Linnaeus	X*	X	X*	X*	X
Barn swallow. *Hirundo rustica* Linnaeus	—	—	X	X*	X
Bell's vireo. *Vireo bellii* Audubon	X*	—	—	X	—
Belted kingfisher. *Ceryle alycon* (Linnaeus)	—	X	—	X	—
Black-billed cuckoo. *Coccyzus erythropthalmus* (Wilson)	X*	—	—	—	—
Black-capped chickadee. *Parus atricapillus* Linnaeus	—	—	—	X	—
Blue grosbeak. *Guiraca caerulea* (Linnaeus)	X	—	—	—	—
Blue jay. *Cyanocitta cristata* (Linnaeus)	—	X	X	X	—
Blue-winged teal. *Anas discors* Linnaeus	X*	X*	—	X*	X
Bobolink. *Dolichonyx oryzivorus* (Linnaeus)	—	—	—	—	X
Brown thrasher. *Toxostoma rufum* (Linnaeus)	—	—	X	X*	X
Brown-headed cowbird. *Molothrus ater* (Boddaert)	X*	X	X	X*	X
Canada goose. *Branta canadensis* (Linnaeus)	—	X	—	X*	—
Common grackle. *Quiscalus quiscula* (Linnaeus)	—	X	X	X	X
Common moorhen. *Gallinula chloropus* (Linnaeus)	X*	—	—	X	—
Common yellowthroat. *Geothlypis trichas* (Linnaeus)	—	X	X	X	X
Dickcissel. *Spiza americana* (Gmelin)	X*	—	X	X	X
Downy woodpecker. *Picoides pubescens* (Linnaeus)	—	X	—	—	—
Eastern kingbird. *Tyrannus tyrannus* (Linnaeus)	X*	X	X	X*	X*
Eastern meadowlark. *Sturnella magna* (Linnaeus)	—	—	—	X	—
European starling. *Sturnus vulgaris* Linnaeus	—	X	—	X*	—
Field sparrow. *Spizella pusilla* (Wilson)	—	—	—	X	—
Grasshopper sparrow. *Ammodramus savannarum* (Gmelin)	—	—	X	—	X
Gray catbird. *Dumetella carolinensis* (Linnaeus)	—	X	—	X*	—
Great horned owl. *Bubo virginianus* (Gmelin)	—	X	—	X*	—
Great-tailed grackle. *Quiscalus mexicanus* (Gmelin)	X*	X	X	X*	—
Green-backed heron. *Butorides striatus* (Linnaeus)	—	—	—	X	—
Green-winged teal. *Anas crecca* Linnaeus	—	—	—	X	—
House sparrow. *Passer domesticus* (Linnaeus)	X*	X*	—	X*	—
House wren. *Troglodytes aedon* Vieillot	—	—	—	X*	—
Killdeer. *Charadrius vociferus* Linnaeus	X*	X*	X*	X	X
King rail. *Rallus elegans* Audubon	X	—	—	—	—
Least bittern. *Ixobrychus exilis* (Gmelin)	X*	—	—	X*	—
Mallard. *Anas platyrhynchos* Linnaeus	X*	X*	—	X*	—
Marsh wren. *Cistothorus palustris* (Wilson)	—	—	—	X	—
Mourning dove. *Zenaida macroura* (Linnaeus)	X*	X*	—	X*	X*

Table IV (Continued on page 10)

Table IV (Continued from page 9)

Northern bobwhite. *Colinus virginianus* (Linnaeus)	—	—	—	X*	X
Northern cardinal. *Cardinalis cardinalis* (Linnaeus)	—	—	—	X	—
Northern flicker. *Colaptes auratus* (Linnaeus)	—	—	—	X*	X
Northern oriole. *Icterus galbula* (Linnaeus)	—	X	X	—	—
N. Rough-winged swallow. *Stelgidopteryx serripennis* (Audubon)	—	—	—	X*	—
Northern shoveler. *Anas clypeata* Linnaeus	X*	X	—	—	—
Orchard oriole. *Icterus spurius* (Linnaeus)	X*	X	—	X*	X
Pied-billed grebe. *Podilymbus podiceps* (Linnaeus)	X*	X	—	X*	—
Red-headed woodpecker. *Melanerpes erythrocephalus* (Linnaeus)	—	X	—	X*	—
Red-tailed hawk. *Buteo jamaicensis* (Gmelin)	—	X	—	X*	X
Red-winged blackbird. *Agelaius phoeniceus* (Linnaeus)	X*	X*	X	X*	X*
Ring-necked pheasant. *Phasianus colchicus* Linnaeus	—	X*	X	X	X
Rock dove. *Columba livia* Gmelin	X*	—	—	—	—
Rose-breasted grosbeak. *Pheucticus ludovicianus* (Linnaeus)	—	X	—	X	—
Ruddy duck. *Oxyura jamaicensis* (Gmelin)	X*	X	—	—	—
Sedge wren. *Cistothorus platensis* (Latham)	—	—	—	X	—
Song sparrow. *Melospiza melodia* (Wilson)	X*	—	X	X	—
Sora. *Porzana carolina* (Linnaeus)	—	X	—	X*	X
Spotted sandpiper. *Actitis macularia* (Linnaeus)	X*	—	X	—	—
Tree swallow. *Tachycineta bicolor* (Vieillot)	X*	—	—	—	—
Virginia rail. *Rallus limicola* Vieillot	X*	X	—	—	—
Warbling Vireo. *Vireo gilvus* (Vieillot)	X	—	—	X	—
Western Kingbird. *Tyrannus verticalis* Say	X*	X	—	—	—
Western Meadowlark. *Sturnella neglecta* Audubon	—	—	X	X	X
Willow Flycatcher. *Empidonax traillii* (Audubon)	—	—	X	X	—
Wood Duck. *Aix sponsa* (Linnaeus)	X	—	—	X*	—
Yellow Warbler. *Dendroica petechia* (Linnaeus)	X*	X	—	X	—
Yellow-billed Cuckoo. *Coccyzus americanus* (Linnaeus)	X*	X	—	X	—
Yellow-headed Blackbird. *Xanthocephalus xanthocephalus* (Bonaparte)	X*	—	—	X*	—
Number of species with: Confirmed nesting	30	7	2	29	3
Possible or probable nesting	4	28	18	24	18
TOTAL	34	35	20	53	21

INVERTEBRATES

Another notable biotic feature of the saline marshes is a mosquito, *Aedes sollicitans* (Walker), that has been collected in Nebraska only here (Lunt and Rapp, 1981). A beetle of very limited occurrence in Nebraska has been observed at the saline flat near the Lincoln airport (1987, B. Ratcliffe, personal communication).

WETLAND LOCATIONS AND CHARACTERISTICS

Saline wetland soils are less than 1% of the land area in Lancaster County (Soil Conservation Service, 1980), but they have very diverse wildlife habitats. Relatively bare, open flats with true salt-marsh halophytes are extensive at some sites, but others have extensive growths of cattails and sedges. Cordgrass meadows survive on some lowland areas along creeks, and on the fragments of untilled upland there is woodland and prairie grassland.

Below is a listing of saline wetlands along Salt Creek and Little Salt Creek, including legal and general descriptions and comments on their biota and present condition.

1. Airport Flats

N ½ of the NW ¼ of Section 21, T1ON, R6E.
Soils: *Sa, Sb*

The area is mostly saline meadow in what was once known as the Salt Basin, and is now known as Capitol Beach. Interstate Highway 80 separates this tract from lakeside property along Capitol Beach (Salt) Lake, and therefore the area has no ready access. Erosion could become a problem if repair of the berm on the east side of the Flats is not made. The runways of the Lincoln Airport are adjacent, and should prevent development of this area.

2. Capitol Beach (Salt Lake)

NE ¼ of Section 21 and NW ¼ of Section 22, T1ON, R6E.
Soils: *Sb* and *Sc* to the east of the lake

This was the historic Salt Basin. A dam built in the 1890's increased the depth and extent of standing water (Barbour, 1895). Bird watchers have enjoyed visiting this spot for decades because of the unusual avifauna (Ducey, 1985). Small, marshy areas, including semi–permanent wetland basins, remain east of the lake along an intermittent stream that flows into Salt Creek. More than 30 species of birds have been noted during the breeding season, and nearly all are confirmed nesters. Eight are species not recorded at other salt-marsh localities: northern shoveler, ruddy duck, king rail, Virginia rail, black–billed cuckoo, western kingbird, tree swallow, and blue grosbeak. The king rail and common moorhen are especially notable.

Most of the Capitol Beach wetland has been destroyed by residential and industrial development. The remaining small areas are threatened by further industrial encroachment, and camping by transients and dumping of debris further degrade the value of the area for wildlife.

3. Burlington Northern Railroad Yards

N ½ of Sections 28 and 29, T1ON, R6E.
Soil: *Sc*

This area, also on the west side of Lincoln, was an area where several saline plant communities once grew in soils of different salinity (Shirk, 1924). It has been mostly destroyed since then by development of railroad facilities such as switching yards and parking lots, and there is no valuable saline area remaining. Only very small, heavily disturbed areas remain. Salt grass and annual iva are still present in a few places, as are seablite, saltgrass, and spearscale.

Along Middle Creek in the southern half of section 27, to the south of the railroad yards, is a sizeable tract with wetland basins, salt flats, and lowland grassland with scattered trees. This area is being disrupted by construction of the K and L street extensions, and a park will be constructed in the remaining area.

4. Oak Lake

SW ¼ of Section 14, T1ON, R6E.
Soils: non–saline

Formerly there were two lakes, but one was bisected by Interstate Highway 180, and now there are three. They contain some plants of saline waters, most notably ditch-grass.

5. Lagoon Park

SW ¼ of Section 32, T11N, R7E.
Soils: *Sb, Sc*

The saline habitat is a weed–free saline meadow southeast of the west lake. Saltgrass is predominant, with many other unusual species more typical of western grasslands: rough dropseed, western wheatgrass, blue grama, and buffalo–grass. Cordgrass grows along the edge of the lake. Prickly–pear cactus occurs here, its only known occurrence in saline communities in the Lincoln area.

The permanent deep–water habitat has a good number of aquatic plant species, including *Ludwigia peploides,* which has been collected here and only at one other site in the State. Other species are redscale, seaside heliotrope, swamp milkweed, yerba–de–tajo, and numerous sedges. A cattail marsh is at the northern edge of the east lake.

Burning, which improves grasslands, was done by the Wachiska Audubon Society in 1987. The area will be developed as a city park when the adjacent city landfill is abandoned.

The best saline habitat is immediately adjacent to the city landfill. A fence separates the two areas, but trash blows into the meadow. A more serious threat would be earth–moving that will be needed to grade the surface of the landfill. Such activity would destroy the small saline meadow. Drainage from mounds of earth–covered trash could influence the growing conditions of the meadow. The Lincoln Parks and Recreation Department recognizes the value of this area and plans to designate the lagoon area for natural history uses.

Improvement of this area would provide an anchor site for additional protection efforts to the north and west along Little Salt Creek. Drainage work by the City of Lincoln has diverted the constant flow of water that once drained into the lake, and since then there has been greater fluctuation in water levels. The permanent results of this change in the water regime are uncertain.

6. North 40th Street

NW ¼ of Section 32, T11N, R7E; NE ¼ and NE ¼ of the NW ¼ of Section 31, and W ½ of SE ¼ of Section 30.
Soils: *Sb, Sc*

The second area (Section 31) has an excellent example of cordgrass meadow. A small cattail marsh continues to the east, and joins with the first site given above. The meadow continues along the flats adjacent to the creek, but to the west it has been affected by agricultural plowing, which was unsuccessful, and the potential for re–establishment of cordgrass appears good. The property is also seriously disturbed by overgrazing. Some areas of the saline flats have an extensive growth of western wheatgrass, kochia, and wild barley.

The best example of saline flats occurs in Section 30. The flat land has open areas of mud and clumps of vegetation. The typical salt marsh indicator plants—saltwort, sea blite, spearscale, annual iva—grow among areas of alkali bluegrass. To the north is a growth of sedges that grades into a small cattail marsh. This site has fewer weeds than any other meadows visited, has the best remaining examples of salt-flat vegetation, is an excellent place to observe shorebirds, and appears to be the least disturbed of any of the meadows visited.

The area is threatened by erosion and periodic agricultural disturbance. Control of erosion, removal of cattle, and periodic burning would improve chances of survival of the plants. A threat to the north is a change in drainage. The flats are dissected by ditches formed by runoff, and erosion will continue to deepen them. This could change the soil-water characteristics, and an increase in runoff would drain the small, shallow basins that retain water. The landowner to the south closed a dike to reduce erosion on his property, causing the southern half of the area in Section 30 to be flooded through spring, but it is usually dry by early summer.

There are extensive saline flats directly to the west, across the railroad from the site described above, in the N ⅔ of the W ½ of Section 31, T11N, R6E. The soils there are *Sa, Sb,* and *Sc*. These open flats have been used for agriculture, especially for grazing cattle, and a portion was plowed in 1985 for cropland.

7. North 27th Street

W ½ of the SW ¼ Section 19, T11N, R7E.
Soils: *Sa, Sb, Sc*

7a. Arbor Lake

On the east side of the road is an extensive area of saline meadow and an open, slightly vegetated mud flat. The meadow has alkali bluegrass, saltwort, sea blite, spearscale, and annual iva. Saltmarsh aster occurs here and at nearby saline sites, its only known locations in the State. Texas dropseed also is found here and nearby, some of the few sites it is known from in the State. Bearded sprangletop is common in the State but the population here has different floral characteristics that make the plants especially interesting (D. Sutherland, personal communication).

Disturbance in this area appears to be limited to erosion, which is beginning to cut into the flats on the south end. The water-retention dike along the south property line has a hole, and the runoff and erosion rates have increased.

Shorebirds are numerous when standing water is present, especially during migration. Killdeer and red–winged blackbirds are the primary breeding species on the flats and limited emergent vegetation.

7b. Federation Marsh

On the west side of the road is a very diverse area of woodland, grassland, and wetland, but there is little saline wetland. The only example is saltgrass in a saline meadow; bluestem and cordgrass also occur. There is also open water and cattail–sedge marsh. Seaside heliotrope was collected at the edge of one basin, on bare mud during low water, the only record of this western species from eastern Nebraska.

Water is usually pumped from adjacent Little Salt Creek each year to raise water levels and improve conditions for hunting of waterfowl. This influx of freshwater may influence the salinity of the wetlands, reducing growth of salt-marsh plants, but the water attracts a large diversity of migratory and breeding birds.

Most of the flats along the creeks have been heavily disturbed, and apparently an attempt was made to cultivate the property early in the century, according to the landowner. As a result, the predominant plants are annuals, including ragweeds, sunflowers, thistles, and Japanese brome, but there are some native species where the ground is wet.

Another area of grassland occurs on upland on the eastern edge of the site. There are native plants, including bluestem, gayfeather, and wild rose. This prairie is very disturbed and would require extensive rejuvenation. There are two areas of successional grassland. The upland site on the western edge is predominantly rough dropseed and little and big bluestems. The shrubby western snowberry is invading the area. On low land along the creek the successional area is mostly Kentucky bluegrass and smooth brome. Woody plants include ash, locust, hackberry, elm, and snowberry.

Remnant riparian woodland occurs along the eastern and western edges of the site. The grove on the east side is almost entirely of elm, with a few cottonwoods along the edge of the basin. The woodland on the west side of the basin has thickets of American plum, ash, locust, mulberry, willows, snowberry, and juniper. They are very dense in places and provide extensive cover for wildlife. There is a replanted warm-season grassland west of the wetland area, in which big bluestem and Indiangrass are planted.

This site has the highest diversity of breeding birds, with 30 of its 50 recorded species known to nest there.

A potential threat to the area is erosion of the dike on the lower end of the east site. Burning would control weed growth along the creek and remove exotic species from the remnant upland prairie.

8. North Little Salt Creek

The lowland along Little Salt Creek north of Lincoln is still mostly native vegetation; it is used only for grazing because it is so wet and saline. The two sites listed here represent the most notable areas identified and visited; other saline areas can be expected elsewhere along the creek, where appropriate soils exist.

8a. First Street and Raymond Road

S ½ of the NW ¼ of Section 2, T11N, R6E.
Soils: *Sa, Sb*

This area is heavily grazed by the lessee, but there is excellent potential for rejuvenation of the wetland and native prairie on the nearby upland through reduction in grazing intensity. The habitat diversity is very good.

The lowland area includes lowland cordgrass meadow, small saline flats, limited cattail marshes, and two channels of Little Salt Creek. Saline plants noted on the bottomland include spearscale and saltwort.

On the upland in the southwest corner of this tract is a native prairie with big bluestem, little bluestem, blue grama, switchgrass, sideoats grama, and gayfeather. A small area where there was once a quarry has two ponds, and the excavation work has exposed Dakota sandstone. There is an oxbow lake to the west, along the creek.

8b. Little Salt Fork

T12N, R6E, middle ⅓ of W ½ of Section 34
Soils: *Sa, Sb*

This area has several marsh habitats along two forks of Little Salt Creek, and is biologically rich. There are mud flats, emergent wetland, lowland meadow, and upland bluestem prairie. There are rolling hills of native prairie with wetlands between them. The increase in elevation creates a transition from barren ground and meadow along the creek to wetlands and upland prairie. Grazing has reduced the biotic diversity.

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